



PIER Energy-Related Environmental Research

Environmental Impacts of Energy Generation, Distribution and Use

Public Health Benefits of End-Use Electrical Energy Efficiency in California

Contract #: 500-02-004

Contractor: University of California, Lawrence Berkeley National Laboratory

Contract Amount: \$75,000

Match Funding: None

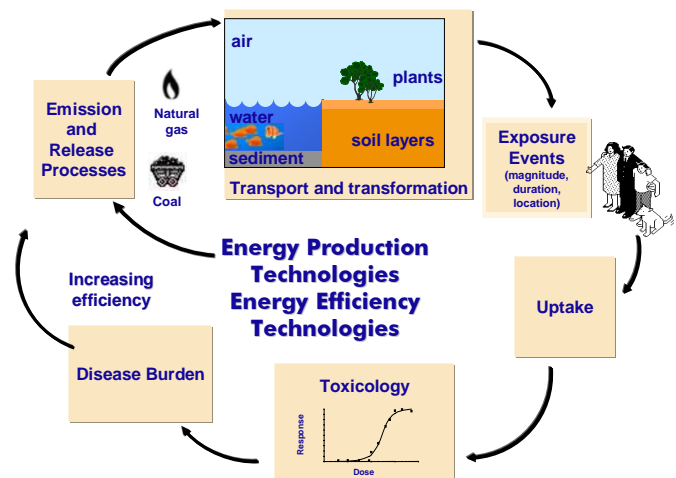
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The Issue

Providing electricity to California results in potentially significant health and environmental impacts. The Externalities of Energy (ExternE) research project of the European Commission has evaluated public and occupational impacts for a number of energy production technologies. ExternE reports that the value of public and occupational health impacts attributable to energy use is on the order of \$25,000 per gigawatt-hour (GWh) produced from coal-fired power plants and \$4,000 per GWh produced from natural gas power plants.¹ In 2001, California produced 10% or 27,636 GWh of its electricity from coal and 43% or 113,145 GWh of its electricity from natural gas.²



Various emissions from fossil-fired electric generation have adverse impacts on human health and the environment. These emissions can be reduced by (1) using cleaner generating technologies, and/or (2) using more efficient end-use technologies, so that less electricity needs to be generated in the first place.

Over recent decades, several studies have attempted to quantify the health and environmental impacts of various energy systems. However, because these comparative studies have excluded end-use energy efficiency from the mix of technologies considered, there remains an important gap in the information available to policy makers for making informed decisions on California's energy choices. This project will facilitate a better understanding of the financial costs and environmental/health implications of both the technologies used to increase supply and those used to reduce end-use consumption and demand.

¹ ExternE. 2004. Externalities of Energy, a research project of the European Commission. Reports on methods and findings are available at <http://externe.jrc.es/index.html>.

² California Energy Commission. website 2002, <http://www.energy.ca.gov/html/energysources.html>.

Project Description

This exploratory project will develop and demonstrate a conceptual model, data, and a data management process to calculate the net health benefits of increasing the end-use efficiency of electric energy in California. The project will build on the foundation of standard life-cycle impact assessment methods that have been developed for evaluating and allocating the health and environmental impacts of energy technologies. An important issue here is that the mix of energy technologies whose contribution is avoided by energy efficiency is not the same as the average mix of technologies used for overall electricity production; i.e., efficiency will impact peaking plants more than baseload coal and nuclear plants. Peaking plants are more likely to be close to urban regions and thus have a more direct impact on human health. In addition, the project will consider the occupational as well as environmental impacts attributable to both power plants and energy-saving technologies.

In this exploratory phase of the project, health impacts for energy production fuel cycles (from the mix of energy production facilities whose use is likely to be avoided) will be based on emissions of criteria air pollutants, toxic air pollutants, and hazardous substances released to water or transferred to disposal sites. The project will develop a harmonized measure of potential harm by translating all health impacts into a single measure of disease burden. Outcomes will be organized according to residential and commercial sectors and sorted according to the technology/material used to increase efficiency.

The framework for assessing net efficiency benefits for California will be demonstrated with a case study based on particles (e.g., PM_{2.5}), NO_x, benzene, and polycyclic aromatic hydrocarbons (PAHs). The end product of this research will be a spreadsheet, which will allow policy makers to plug in numbers for different decision scenarios and assess the impacts/benefits of energy conservation technologies (compare the added impacts of energy efficiency technologies to the impacts of avoided power generation).

PIER Program Objectives and Anticipated Benefits for California

This project offers numerous benefits and meets the following PIER program objectives:

- **Providing environmentally sound electricity.** The framework developed in this project will enable reliable and transparent calculations of the net benefits of energy efficiency specific to the California market, as well as more explicit consideration of environmental effects within the broader decision making process. By facilitating direct comparison of supply and end-use technology options, this study will help policy makers determine which options provide the lowest emissions per GWh of electric production.
- **Reducing California's health costs.** Based on California Energy Commission data for coal- and natural gas-based power production for California and the ExternE numbers for health impacts, the estimated value of health impacts from these two power sources alone amounts to an annual equivalent disease burden of approximately \$1.1 billion in California. Although these preliminary estimates are based on numbers that have not been fully validated for California, they reveal the significant health benefits that could be achieved for every fraction of fossil-fueled power generation that is avoided through energy efficiency measures.

Final Report

The final report for this project will be available in summer 2006 and will be posted at <http://www.energy.ca.gov/pier/environmental/reports.html>.

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